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ABSTRACT

Using the Motivated Strategies for Learning Questionnaire, this study examined the effects of 11 learning strategies variables, ability, and gender on the verbal and mathematics Scholastic Aptitude Test (SAT) scores of approximately 300 black high school seniors. The students took the SAT during the fall of the 1989-90 school year. Learning strategies variables were: (1) rehearsal; (2) elaboration; (3) organization; (4) critical thinking; (5) planning; (6) monitoring; (7) self-regulation; (8) time and study environment; (9) effort; (10) peer help; and (11) help-seeking behavior. Multiple regression equations demonstrated that the self-regulation variable had significant positive effects on verbal and mathematics SAT scores. Help-seeking behavior had significant positive effects on the verbal score, while critical thinking had an inverse effect on the mathematics score. Ability had significant positive effects on both scores, while significant sex differences were found for self-regulation strategies in favor of males for verbal and mathematics scores. While the effect of organization was positive in favor of females on the mathematics SAT scores, the effect of critical thinking was inverse. Ability favored females on the verbal SAT scores and males on the mathematics scores. Results are significant in view of efforts to help black students improve SAT scores. One figure and 3 tables present study findings, and there is a 50-item list of references. (SLD)

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The Effects of Learning Strategies on a Group of Black Secondary Students' Verbal and Mathematics SAT Scores

ED344918

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Paper presented at the annual meeting of the American Education Research Association, San Francisco, California, April 24, 1992.

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ABSTRACT

Utilizing the Motivated Strategies for Learning Questionnaire, the present study examined the effects of 11 learning strategies variables (Rehearsal, Elaboration, Organization, Critical Thinking, Planning, Monitoring, Self-Regulation, Time and Study Environment, Effort, Peer Help, and Help-Seeking Behavior) on a group of black secondary Grade 12 students' Verbal and Mathematics SAT scores. Approximately three hundred black students in their senior year in high school who had taken the SAT during the Fall semester participated in the study. The present study also examined the effects of the variables Ability and Sex on the particular group of black students' Verbal and Mathematics SAT scores. Ability was determined by the verbal and mathematics scores that the students had obtained on the Metropolitan Achievement Test, form 6 during their Grade 9 year.

From the multiple regression equations, the variable Self-Regulation strategies was found to have significant, positive effects on the Verbal and the Mathematics SAT scores. The variable Help-Seeking Behavior indicated significant, positive effects on the Verbal SAT score. The variable Critical Thinking suggested a significant effect on the Mathematics SAT scores, but the effect was in the inverse direction. The varibale Ability revealed significant, positive effects on the Verbal and the

Mathematics SAT scores while the variable Sex indicated a significant, inverse effect on the Mathematics SAT scores.

As a result of the significant, inverse effect of the variable Sex on the Mathematics SAT scores, separate regression equations of the effects of the independent variables by sex on the Verbal and Mathematics SAT scores was performed. Significant sex differences were found on the variable Self-Regulation strategies in favor of males on the Verbal SAT scores and on the Mathematics SAT scores. Significant sex differences found on the variables Organization and Critical Thinking on the Mathematics SAT scores favored females. While the effect of the variable Organization was positive in favor of females on the Mathematics SAT scores, the effect of Critical Thinking was inverse. Further significant sex differences were indicated on the variable Ability which favored females on the Verbal SAT scores and males on the Mathematics SAT scores.

The results of the present study are significant in view of efforts to help black students' SAT scores to be comparable with those of other ethnic groups. Subsequently, the findings of the present study may incite further examinations of the variables examined. The findings also suggest that black students' SAT scores can be improved.

In the past two and a half decades, there has been a decline in secondary students' scores on the Scholastic Aptitude Test (SAT) which has caused great concern about the quality of education students are receiving (Brown, 1987; McGeever, 1983), especially black secondary students. Comparatively, black secondary school students' average Verbal SAT score of 352 is 90 points and 72 points below the Verbal SAT average of white secondary students and of the nation (442, 424), respectively. Black students' Mathematics SAT average of 385 is lagging 106 points and 91 points behind white secondary students' average of 491 and the national average of 476 (College Board, 1990).

Although the SAT is an aptitude test, its assessment of verbal skills (vocabulary, verbal reasoning, and reading comprehension) and of mathematics skills (problem solving in arithmetic, elementary algebra, and geometry) is an indicator of students' achievement by their senior level in high school for which black students are demonstrating deficiencies. The gains black students have shown on the SAT over the past ten years have not been substantial enough to equalize their scores. Brief coaching programs have resulted in only minimal gains on students' SAT scores (Alderman & Powers, 1980; Kulik, Bangert, & Kulik, 1982; Messick & Jungeblut, 1981; Powers & Alderman, 1983) and even less effective on black students' Verbal SAT scores (Zuman, 1988).

Theoretical Framework

One area of research which has implications for improving black students' performance on the SAT is that of students' awareness or cognition of how they are approaching academic goals. Recent studies have begun to investigate the critical impact of students' independent use of learning strategies on academic achievement (McKeachie, Pintrich, & Lin, 1985; Pintrich, 1989; Weinstein & Underwood, 1985; Zimmerman, &

Palmer, 1985). This research is predicated on the assumption that academic achievement can be improved by examining the strategies students utilize while learning (Weinstein, 1982; Weinstein & Mayer, 1986).

This student-cognition paradigm suggests that students' awareness of the strategies they are utilizing to process information helps them to become independent learners and enables them to monitor and regulate their own academic achievement for any academic goal (Pintrich, 1989; Thomas & Rowher, 1986; Weinstein & Mayer, 1986). From this perspective, the capability to learn independently in the acquisition of knowledge is a generalizable and a lifelong asset and implies a greater importance on academic achievement than curriculum-based instruction.

Although critics generally attribute black students' low performance on the SAT to their knowledge level, a few studies have found that inadequate test-taking strategies (a subcomponent of self-regulation learning strategies) account for a large proportion of the poor scores obtained by black students on standardized tests (Frierson, 1984). Several studies have shown that learning strategies improve academic performance on curricular-criterion and on standardized-criterion measures (Marron, 1965; Pallone, 1961; Zimmerman & Pons, 1986). These studies, however, have not examined the effects of learning strategies on specifically black students' verbal and mathematics achievement relative to those on the SAT.

Statement of the Problem

Although several research studies have focused on the improvement of verbal and mathematics achievement similar to the verbal and mathematics concepts included on the SAT, very few studies have focused directly on how to improve students' Verbal and Mathematics SAT scores. Studies have reported significant effects of learning strategies on students' verbal and mathematics achievement, yet studies have not actually investigated whether these same variables can be used to increase students' Verbal and

Mathematics SAT scores. There is still a lack of studies on whether variables such as learning strategies can be manipulated to help students successfully master the verbal and mathematics concepts assessed on the SAT, particularly black students.

At least 70 questions of the 85 questions on the Verbal SAT component measure competency on antonyms, analogies, and reading passages. For these academic skills, learning strategies such as elaboration, organization, planning, monitoring, and self-regulation have proved most successful. Therefore, these learning strategies may have similar effects on the verbal and mathematicsthose dimensions on the SAT. Furthermore, since the variables learning strategies and ability to a certain extent, have been found alterable, perhaps they can be utilized to improve black students' performance on the SAT.

Interestingly, the apparent lag of black secondary students' SAT scores behind white students' SAT scores has received much attention, but relatively few efforts have concentrated on how to help these students improve their SAT scores. Therefore, the issue of black secondary students' performance on the SAT must be addressed, and the variables that have been found to significantly influence verbal and mathematics achievement need to be examined for similar effects on Verbal and Mathematics SAT scores. The challenge incumbent on educators is to determine whether these same variables are significantly related to SAT scores as they seek to increase the performance of black students in the present study and of similar black students on the SAT.

Purpose

Despite the increasing concern about black secondary students' low performance on the SAT, very little attention has been given to educational interventions that may be used to increase the scores. Although the SAT is not a direct measure of what students have learned from classroom instruction, it does measure students' competency on some basic verbal skills in reading comprehension, vocabulary, verbal reasoning, and

mathematics skills in problem solving in arithmetic, elementary algebra, and geometry (Turnbull, 1985) in which they should have accomplished by their senior year in high school. Students' performance on the preceding verbal and mathematical skills are useful in assessing the academic preparation of students completing secondary schools. Learning strategies have exhibited remarkable improvements on verbal and mathematics achievement in various academic areas.

Therefore, the purpose of the present study is to examine the effects of learning strategies on black students' Verbal and Mathematics SAT Scores. More specifically, do learning strategies significantly affect black students' performance on the verbal and mathematics sections of the SAT? Secondly, the study will determine whether students' ability as measured by their performance on the verbal and mathematics components of the Metropolitan Achievement Test, Form 6 (MAT6) significantly impact the Verbal SAT scores and Mathematics SAT scores. Also, due to the wide differences in the performance of males and females on mathematics and verbal achievement, the present study will compare males and females on the Verbal and Mathematics SAT scores.

Research Questions

The literature has revealed that learning strategies have consistently been found to enhance students' verbal and mathematics achievement. This study will therefore investigate the following questions:

1. What are the effects of learning strategies on black secondary students' Verbal and Mathematics SAT scores?
2. Are there differential effects by students' ability and sex on the Verbal and Mathematical SAT scores?

Review of the Literature

Recent investigations have established strong relationships between learning strategies and students' academic achievement. Pintrich (1989) argues that learning strategies facilitate the storage and retrieval of information. Hunt (1978) states that speed

in retrieving information, especially lexical information, is a critical determinant of verbal achievement. Corno and Mandinach (1983), in summarizing several studies on the relationship between learning strategies and verbal achievement, reported that learning strategies significantly impacted verbal achievement.

Hunt (1978) clearly pointed out that students who used learning strategies were able to manipulate information regardless of its meaning which significantly increased their verbal comprehension on verbal aptitude tests such as the Scholastic Aptitude Test (SAT), Verbal composite (SAT-V). Bruning (1982) found that learning strategies improved student' performance on classification tests. Stevens (1988) conducted a study on students' ability to select the main idea of expository passages. Findings revealed that students who utilized learning strategies were better able to select main ideas than students who did not use learning strategies.

Turnure, Buium, and Thurlow (1976) concluded that learning strategies techniques improved the verbal achievement of a group of American nonretarded and educable retarded children. This result prompted another study involving children from Israel (Buium & Turnure, 1977). Findings indicated that children who used learning strategies performed better on verbal measures similar to the children from America in the preceding study.

Larkin (1981) was interested in improving students' academic achievement in physics. The effect of teaching learning strategies evidenced a significant improvement on criterion-physics measures. Vaidya and Chansky (1980) examined the relationship between learning strategies and the total mathematics achievement test scores of second-, third-, and fourth-grade students on the SAT Primary Levels I, II, and III, respectively. The results revealed that learning strategies were positively related to the mathematical concepts, computation, and application subtests of the mathematics achievement test.

Swing and Peterson (1988) found that learning strategies also improved a group of fifth-grade students' achievement on mathematics.

Method

Subjects

The subjects participating in this study consisted of 300 Grade 12 black students ranging from 17 to 19 years of age. The students represented six secondary high schools in a large metropolitan school district located in the Southwestern Region of the United States. A profile of the schools is found in Figure 1.

Black students represented 79% of the students in School 1, 89.6% in School 2, 49.9% in School 3, 97.3% in School 4, 76.5% in School 5, and 87.4% in School 6. The number of students that graduated from these schools ranged from 85.7% to 97.8%. Most of the schools had more male students than female students and more students at the Grade 9 level and the least number of students at the Grade 12 level. Approximately 50% or more of the students at four of the schools (Schools 1, 2, 3, and 6) pursued college. At school 5, 43% of the students pursued college. At School 4, out of 1960 students enrolled only 27% entered college. At four of the schools, over 10% of the students were considered "at risk" while at the remaining two schools 2% to 5% of the students were characterized "at risk."

The students in the sample took the SAT during the fall of the 1989-1990 school year. The SAT was administered October, 1989; November, 1989; December, 1989; and January, 1990. The SAT administered in January, 1990 was taken before the end of the

Figure 1

Profile of Schools

SCHOOL	1	2	3	4	5	6
POPULATION	1823	1413	689	1960	1365	1552
LOCATION	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
% ETHNIC BREAKDOWN	W=2.1 B=79 H=16.6 A=2.3	W=2.6 B=89.6 H=6.0 A=1.8	W=9 B=49.9 H=17.7 A=23.4	W=.5 B=97.3 H=1.2 A=1.0	W=2.5 B=76.5 H=20.6 A=.4	W=5.2 B=87.4 H=6 A=1.4
DISTRIBUTION BY GENDER	M=947 F=876	M=782 F=631	M=212 F=477	M=997 F=963	M=560 F=805	M=846 F=706
DISTRIBUTION BY GRADE	9th=699 10th=400 11th=367 12th=357	9th=547 10th=319 11th=266 12th=281	9th=191 10th=165 11th=159 12th=174	9th=594 10th=478 11th=410 12th=478	9th=489 10th=315 11th=286 12th=275	9th=487 10th=406 11th=362 12th=297
FACULTY DISTRIBUTION	M=38 F=63	M=36 F=50	M=9 F=25	M=50 F=50	M=34 F=48	M=36 F=39
ADMINISTRATORS	4	4	2	6	4	6
% OF STUDENTS THAT GRADUATE	88.1	89.1	97.8	85.7	94.8	86.6
% OF STUDENTS THAT GO ON TO COLLEGE	78	72	95	27	43	50
% OF STUDENTS RECEIVING FREE/REDUCED LUNCH	F=13 R=2	F=19 R=2	F=6 R=1	F=20 R=2	F=20 R=2	F=18 R=2
% OF STUDENTS CONSIDERED "AT RISK"	11.9	10.9	2.2	14.3	5.2	13.4

first semester. Therefore, it was considered as having been taken during the Fall school term.

Instruments

The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, & McKeachie, 1989) was the standardized instrument used in the present study. The instrument was chosen for its consistency in measuring the variables in this study. The instrument , however, was slightly modified so that the items would represent overall student achievement rather than subject-specific achievement.

The Motivated Strategies for Learning Questionnaire (Pintrich, Smith, & McKeachie, 1989) is a self-report measure that assesses the constructs of Cognitive, Metacongitive, and Resource Management. The MSLQ is basically composed of two major components (Motivation and Learning Strategies). However, it is designed in a manner in which the different components are used singly and separately (Pintrich, Smith, & McKeachie, 1989). In the present study, the Learning Strategies Component was utilized. Responses are on a 7-point Likert scale. Students indicated their level of agreement with statements by circling numbers ranging from "not at all true of me" to "very true of me." The instrument has been found to have test-retest reliability and construct and predictive validity. Coefficient alphas for the scales range from .65 to .83. The internal reliability coefficiency that was determined from the Kuder-Richardson Formula-20 is .91. Approximately 15 minutes is required to complete the instrument. A brief description of the scales follows:

Cognitive Strategies - the behaviors and thoughts in which students are engaged in while studying. This includes the subscales rehearsal, elaboration, organizational, and critical thinking.

Rehearsal - reciting or naming items from a list to be learned.

Elaboration - building internal connections between new information and prior information.

Organizational - select appropriate information and construct connections among the information to be learned.

Critical Thinking - ability to use problem-solving skills.

Metacognitive strategies - extent to which students are able to activate, monitor, and regulate their learning. Strategies entail planning, monitoring, and self-regulation.

Planning - plan the use of strategies and the processing of information.

Monitoring - checking comprehension.

Self-Regulation - adjusting learning as needed.

Resource Management Strategies - the extent to which students are able to manage their study environment and the available resources. Time and study environment, effort, peer learning or peer help, and help-seeking behavior are considered under resource management strategies.

Time and Study Environment Management - organizing time for study and selecting a place to study.

Effort - the extent to which students persist on a task.

Peer Help or Peer Learning - students assisting students in learning.

Help-Seeking Behavior - the extent to which students seek the support of others.

The SAT was utilized to determine students' Verbal (antonyms, analogies, sentence completions, and reading passages) and Mathematics (arithmetic, elementary algebra, and geometry) SAT scores. The SAT was the most recent form administered during fall, 1989. The reliability range for the Verbal SAT component was approximately .89 to .90, and the range of reliability for the Mathematics SAT component was .87 to .89. There was no specific validity indicated since it is, in most situations, determined by the various admission criteria of colleges.

The Metropolitan Achievement Test 6 (MAT6) Advanced 1, Form M, that was taken during the spring, 1987 while the students were in Grade 9 was employed to assess students' ability (prior achievement) in reading (comprehension and vocabulary), and

mathematics (concepts, problem solving, and computation). However, the MAT6 was statistically controlled for students' prior achievements. The reliability of the MAT6 ranges from .87 to .95 while the validity ranges from .60 to .85.

Procedures

Near the end of the first semester of the 1989-1990 school year, all students completed the instrument which was distributed and administered concurrently by the homeroom teachers. Students were informed by the homeroom teachers that the questionnaire was not a test and would not be viewed by their teachers. They were then instructed to write their student identification (ID) number, the name of their school, and their sex on the questionnaire. The questionnaire required approximately 15 minutes to complete and was completed during a 25-minute homeroom period. The questionnaires were collected immediately following completion by student representatives and then secured in large envelopes. Envelopes were to taken the Grade 12 counselors immediately following the homeroom period and then collected by the researcher.

Following the administration of the questionnaires, the school rosters by students' ID numbers were examined to match the students' ID numbers with their names. After identifying the students by name, their school records were obtained from the counselors' offices to determine their MAT6 scores and their SAT scores. Students who had not taken the MAT6, who had completed only one section of the MAT6 (Verbal only or Mathematics only), or who had not taken the SAT during the 1989-1990 Fall semester were omitted from the list. Of approximately 450 questionnaires that were administered and collected, 50 of them did not meet the criteria and were eliminated. The 400 remaining questionnaires were assigned number 001 thru 400 and 300 were randomly selected. The six schools were randomly assigned numbers 1 thru 6.

Data Analysis

The statements on the instrument that were stated negatively were recoded. Descriptive statistics were employed to describe the means and standard deviations of the data. Next, Pearson's product-moment coefficients were computed to examine the relationships among the variables. Multiple regression analyses were employed to determine the effects of each of the 13 independent variables (Rehearsal Strategies, Elaboration Strategies, Organizational Strategies, Critical Thinking Strategies, Planning Strategies, Monitoring Strategies, Self-Regulation Strategies, Time and Study Environment Strategies, Effort, Peer Help Strategies, Help-Seeking Behavior Strategies, Ability, and Sex) on each of the two dependent variables (Verbal SAT scores and Mathematics SAT scores). Ability was determined from the reading mathematics sections of the MAT6 and was statistically controlled for initial achievement.

Separate multiple regression equations were developed for each of the two dependent variables Verbal SAT scores and Mathematics SAT scores. The coefficient R-Square (R^2) was utilized to explain the proportion of variance accounted for on each of the dependent variables by a combination of all the independent variables. A setwise regression was performed to examine all of the independent variables at the same time for effects on each of the two dependent variables. In the setwise regression, Beta weights were employed to explain the magnitude of the effect of each independent variable, while the other independent variables were held constant, on each of the dependent variables. Since the Beta weights are in standard score form and on an absolute scale, the magnitude of the Beta weights correspond to the strength of the effect of each independent variable on each of the dependent variables.

Tolerance was computed to determine the extent of multicolinearity in each equation. The tolerance value for each independent variable in each of the two regression equations suggested that there were neglible multicollinearity problems. Subsequently, all of the independent variables were included in the regression model.

An examination of the effects of the variable Sex on the Verbal SAT scores and on the Mathematics SAT scores indicated significant sex differences on the Mathematics SAT scores. Since these sex differences were found, separate regression equations for males and females on the Verbal SAT scores and on the Mathematics SAT scores were also computed. These equations were designed to examine further the effects of the independent variables by sex on the dependent variables Verbal SAT scores and Mathematics SAT scores. Beta weights were considered in determining the magnitude of the effects.

Results

The results of the descriptive statistics showed that the variable Help-Seeking Behavior Strategies had the highest mean (4.69) and Peer Help Strategies the lowest mean (3.93) (on a seven-point, Likert-type scale with seven being the highest possible value). The variable Help-Seeking Behavior Strategies also showed the strongest correlation with the Verbal SAT scores and with the Mathematics SAT scores ($r=.39, p<.001$; $r=.35$, $p<.001$), respectively, excluding the variable Ability with a similar correlation to the Verbal SAT scores ($r=.39$, $p<.001$) and a stronger correlation with the Mathematics SAT scores ($r=.69$, $p<.001$). The means and standard deviations from the descriptive statistics and the correlational matrix from Pearson's product-moment coefficients are reported in Table 1.

The regression equations were used to examine the effects on the independent variables on the dependent variables. The first research question addressed the effects of learning strategies on black secondary students' Verbal and Mathematics SAT scores. In the regression equation explaining the variance (R^2) in the Verbal SAT scores, the 13 independent variables accounted for 27% ($R^2 = .27$) of the variance in the dependent variable. In the regression equation that examined the effects (Beta Weights) of each independent variable on the Verbal SAT scores, the variables Help-Seeking Behavior

Table 1

Means, Standard Deviations, and Intercorrelations Among Variables of the Motivated Strategies for Learning Questionnaire,Ability, and Sex.

Variables	M	SD	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COGNITVE STRATEGIES																	
1. Rehearsal	4.15	.90	.50	.34	.38	.32	.27	.38	.10	.24	.37	.32	.17	.19	.08	.12	-.09
2. Elaboration	4.33	1.12		.49	.60	.51	.49	.55	.12	.38	.38	.51	.22	.20	.11	.17	-.07
3. Organization	4.11	.88			.43	.24	.33	.38	.21	.20	.34	.33	.14	.16	.15	.16	-.08
4. Critical	3.98	.87				.42	.34	.43	.11	.31	.37	.29	.12	.07	.06	.10	-.13
METACOGNITIVE STRATEGIES																	
5. Planning	4.41	.88					.38	.40	.07	.34	.33	.33	.17	.17	.06	.14	-.03
6. Monitor	4.49	.90						.41	.01	.30	.39	.39	.11	.10	.15	.12	.02
7. Self-Regulation	4.48	1.16							.09	.39	.31	.50	.26	.17	.15	.12	.00
RESOURCE MANAGEMENT																	
8. Peer Help	3.93	.94								.18	.12	.11	.05	.07	.06	.09	-.03
9. Time	4.00	.73									.39	.49	.27	.27	.27	.24	-.11
10. Effort	4.25	.96										.33	.19	.14	.12	.14	-.11
11. Help-Seek	4.69	1.18											.39	.35	.26	.31	-.07
12. Verbal SAT	362.08	98.82												.69	.39	.55	-.08
13. Math SAT	403.73	101.24													.28	.69	-.23
14. Read MAT6	704.28	51.09														.55	-.01
15. Math MAT6	697.40	38.14															.13
16. Sex																	

Strategies and Self-Regulation Strategies revealed significant, positive effects on the Verbal SAT scores (Beta =.23, p<.01; Beta = .17, p<.05), respectively.

In the regression equation explaining the variance in the Mathematics SAT scores, 13 independent variables accounted for 54% (R^2=.54) of the variance in the dependent variable. In the regression equation that examined the effects (Beta Weights) of each of the independent variables on the Mathematics SAT scores,the variables Self-Regulation Strategies and Critical Thinking Strategies indicated significant effects on the Mathematics SAT scores (Beta = .14, p<.01; Beta = -.13, p<.05), respectively. The significant effect of the variable Critical Thinking, however, was inverse.

The second research question focused on the effects of ability and sex on the selected group of black secondary students' Verbal and Mathematics SAT scores. The results showed that the variable Ability had a significant, positive effect on the Verbal SAT scores and on the Mathematics SAT scores (Beta = .30, p<.001; Beta = .61, p<.001), respectively. The variable Sex indicated a significant effect on the Mathematics SAT scores, but in the inverse direction (Beta = -.15, p<.001). The results of the regression equations are displayed in Table 2.

Since the variable Sex showed a significant, inverse effect on the Mathematics SAT scores (Beta = -.15, p<.001), a separate regression equation was performed for each dependent variable. The dependent variables by Verbal SAT scores and Mathematics SAT scores were separately regressedby on each of the remaining 12 independent variablesby sex to further examine sex differences'. The results of the regression equations by sex are reported in Table 3. On the Verbal SAT scores, significant sex differences were found on the variable Ability that significantly favored

Table 2

Regression of Learning Strategies, Ability, and Sex Variables on Verbal and Mathematics SAT Scores

Independent Variables	SATV BETA	SATM BETA
Pre-achievement (Ability)	.30***	.61***
Sex	.05	-.15***
LEARNING STRATEGIES		
Rehearsal	.02	.06
Elaboration	.02	.01
Organization	-.05	.02
Critical Thinking	.05	-.13*
Planning	.04	.04
Monitoring	.12	.07
Self-Regulation	.17*	.14**
Peer Help	.01	.02
Time and Study Environment	.02	.04
Effort	.06	.02
Help-Seeking	.23**	.09
	$R^2 = .27$	$R^2 = .54$

* $p < .05$
** $p < .01$
*** $p < .001$

Table 3

Regression of Sex on Verbal and Mathematics SAT Scores

	SATV Beta		SATM Beta	
	Males	**Females**	**Males**	**Females**
Pre-achievement (Ability)	.20	.69***	.65***	.27
LEARNING STRATEGIES				
Rehearsal	.08	.00	.04	.12
Elaboration	.05	.13	.03	.02
Organization	.09	.01	.15	.14*
Critical Thinking	.12	.12	.02	-.27***
Planning	.03	.03	.03	.06
Monitoring	.17	.07	.13	.03
Self-Regulation	.28*	.12	.22**	.13
Peer Help	.13	.07	.05	.01
Time and Study Environment	.08	.03	.00	.07
Effort	.06	.02	.02	.05
Help-Seeking	.23	.09	.14	.08
	R^2=.21	R^2=.64	R^2=.54	R^2=.56

* $p < .05$
** $p < .01$
*** $p < .001$

females (Beta = .69, p<.001) and on the variable Self-Regulation Strategies that significantly favored males (Beta = 28, p<.05).

On the Mathematics SAT scores, significant sex differences were indicated on the variables Ability and Self-Regulation Strategies that significantly favored males (Beta = .65, p<.001; Beta = .22, p<.01), respectively. The variables Critical Thinking Strategies and Organization Strategies significantly favored females (Beta = -.27, p<.001; Beta = .14, p<.05), respectively. As is indicated, the significant effect of the variables Critical Thinking Strategies was inverse.

Of the 13 independent variables examined for significant effects on the Verbal SAT scores, the variable Ability showed the strongest significant effect on the Verbal SAT scores (Beta = .30, p<.001). The variable Help-Seeking Behavior Strategies indicated the second most significant effect on the Verbal SAT scores (Beta = .23, p<.01). The variable Self-Regulation Strategies suggested the third most significant effect on the Verbal SAT scores (Beta = .17, p<.05). None of the other variables was found significant.

On the Mathematics SAT scores, the variable Ability was also found to have the strongest, significant effect (Beta = .61, p<.001). The variable Sex, although inverse, showed the second most significant effect on the Mathematics SAT scores (Beta = -.15, p<.001). The variable Self-Regulation Strategies was found to have the third most significant effect (Beta = .14, p<.01) on the Mathematics SAT scores. The variable Critical Thinking Strategies Suggested the fourth most significant effect on the Mathematics SAT scores (Beta = -.13, p<.05), although the effect was inverse. None of the other variables indicated significant effects.

Since the variable Sex suggested sex differences on the Mathematics SAT scores, a further investigation for differences between males and females on the independent

variables on the Verbal and Mathematics SAT scores was performed. The results revealed significant differences between males and females on the variable Ability that indicated a significant, positive effect on the Verbal SAT scores of females whereas the effect on the Verbal SAT scores for males was not significant. On the other hand, the effect of the variable Ability was significant, positive on the Mathematics SAT scores of males while the effect was not significant on the Mathematics SAT scores for females.

The variable Self-Regulation Strategies evidenced significant, positive effects on both the Verbal and the Mathematics SAT scores for males, but the effect was not significant for females on the Verbal SAT scores nor on the Mathematics SAT scores. The variables Organization Strategies and Critical Thinking Strategies suggested significant effects on the Mathematics SAT scores for females whereas neither of the preceding variables showed a significant effect on the Mathematics SAT scores for males. The significant effect of the variable Critical Thinking Strategies on the Mathematics SAT scores for females, however, was in the inverse direction.

Summary of Results

The regression equations revealed several similarities and unexpectancies. The variable Ability was found to have the strongest significant effect on both the Verbal and the Mathematics SAT scores, but the effect was approximately twice greater on the Mathematics SAT scores than on the Verbal SAT scores (Beta = .61, $p<.001$; Beta = .30, $p<.05$); respectively. The variables Sex and Critical Thinking Strategies had similar significant, inverse effects on the Mathematics SAT scores (Beta = -.15, $p<.001$; Beta =-.13, $p<.05$), respectively.

Unexpectedly, the 13 independent variables accounted for twice more the variance on the Mathematics SAT scores than on the Verbal SAT scores (R^2 =.54; R^2=.27), respectively. Another unexpectancy was that the effect of the variable Ability (Beta =

.61, p<.001) was approximately four times greater on the Mathematics SAT scores than were the variables Sex, Self-Regulation Strategies, and Critical Thinking Strategies on the Mathematics SAT scores (Beta = -.15, p<.001; Beta = .14, p<.01; Beta = -.13, p<.05), respectively. The significant, inverse effect of the variable Critical Thinking Strategies on the Mathematics SAT scores was surprising while the significant, inverse effect of the variable Sex on the Mathematics SAT scores for females was not too astounding, since this inverse effect is somewhat consistent with the literature.

The result of the regression analyses by sex which evidenced that the variable Critical Thinking Strategies inversely affected the Mathematics SAT scores of females was not expected. The significant sex differences for the variable Ability favoring females on the Verbal SAT scores and favoring males on the Mathematics SAT scores were not expected but yet not surprising. Plausible explanations for the significant, inverse effects of the variable Critical Thinking Strategies on the Mathematics SAT scores for females and for the significant, positive effects of the variable Ability on the Verbal SAT scores for females and on the Mathematics SAT scores for males will be addressed in the discussion section of the present study. Unexpectantly, the variables Rehearsal Strategies, Elaboration Strategies, Planning Strategies, Monitoring Strategies, Peer Help Strategies, Time and Study Environment Strategies, and Effort Strategies were not significant in any of the equations for Verbal SAT scores nor for Mathematics SAT scores.

Overall, the variables Help-Seeking Behavior, Self-Regulation Strategies, and Ability revealed significant effects on the selected group of black secondary students' Verbal SAT scores. The variables Self-Regulation Strategies, Critical Thinking Strategies, Ability, and Sex indicated significant effects on the Mathematics SAT scores of the particular group of black students. While the significant effects of the variables Self-Regulation Strategies and Ability on the Mathematics SAT scores were in the

positive direction, the significant effects of the variables Critical Thinking Strategies and Sex were in the negative direction.

Discussion and Conclusion

The first research question focused on whether learning strategies exerted significant effects on the Verbal and Mathematics SAT scores. The results revealed that the variables Self-Regulation Strategies and Help-Seeking Behavior Strategies were the only learning strategies that indicated significant, positive effects on the Verbal SAT scores. The variables Self-Regulation Strategies and Critical Thinking Strategies were the two learning strategies that suggested significant effects on the Mathematics SAT scores, although the effect of the variableCritical Thinking Strategies was inverse.

The second research question addressed the effects of ability and sex on the group of black secondary students' Verbal and Mathematics SAT scores. The results evidenced that the variable Ability indicated the greatest influence on the Verbal SAT scores and on the Mathematics SAT scores. The variable Sex was found to have a significant, inverse effect on the Mathematics SAT scores. Further analyses by sex reported significant sex differences on the variables Ability and Self-Regulation Strategies on the Verbal SAT scores and on the variables Ability, Self-Regulation Strategies, Organization Strategies, and Critical Thinking Strategies, on the Mathematics SAT scores.

The findings of the present study are significant in view of the current concerns and debates over how best to improve black students' performance on the Verbal and Mathematics components of the SAT. The improvement of black students' SAT scores is an important responsibility of educators, especially the schools. The variables found to have significant, positive effects on the Verbal and Mathematics SAT scores of the group of black students in the present study have implications for curriculum design as

preventive and remedial interventions. Subsequently, their inclusion in school curriculums may be considered.

Of the three variables (a) Ability, (b) Help-Seeking Behavior Strategies, and (c) Self-Regulation Strategies that showed significant, positive effects on the Verbal SAT scores, the variable Ability indicated the strongest significant; positive effect. This hierarchical effect of the variable Ability is supported by existing literature and thus adds support to the existing research on the crucial effect of ability on verbal achievement. Several researchers (Uguroglu & Walberg, 1986; Irwin, Engle, Yarbrough, Klein, & Townsend, 1978), for example, strongly argue that ability is the most important and significant factor on verbal achievement.

The significant, positive effect of the variable Ability on the Verbal SAT scores in the present study suggests that an improvement in the particular group of black students' ability may increase their skills in vocabulary, verbal reasoning, and reading comprehension that are included on the Verbal SAT component. Two researchers (Anderson, 1983; Sternberg, 1985) have implied that ability may be alterable, to some extent. Subsequently, efforts may be made to alter the ability of the black students from the population represented in this study. Predicated on the assumption that ability is alterable, the following strategies are suggested for improving Grade 12 students' ability on the Verbal SAT component:

1. At the beginning of the school year, administer domain-referenced ability type tests on vocabulary, verbal reasoning, and reading comprehension. More specifically, administer a vocabulary-ability test, a verbal-reasoning ability test, and a reading comprehension-ability test.

    a. If vocabulary weaknesses are found, vocabulary building with the utilization of prefixes, root words, suffixes may be offered. Application of vocabulary skills may be implemented by encouraging the students to divide words by prefixes, root, and suffixes to determine their meanings.

This approach may be integrated in the content areas of all of the courses that the students are taking. The vocabulary building may also include encouraging students to process words in terms of synonyms, antonyms and homophones.

b. If verbal reasoning is identified as a weakness, instructing the students on analogies is recommended. Provide instruction and application learning activities that include relationships in pairs of words, comprehension of the ideas expressed in the relationships, and recognition of similar or parallel relationships. This strategy may be incorporated in all of the students' content areas.

c. To improve ability on reading comprehension, if needed, students may be encouraged to take generative notes in which the notes are written in the students' own words rather than verbatimly. Paraphrasing materials read and the use of context clues may also be encouraged. To enhance ability on reading comprehension, students may be instructed and trained in skills of elaboration and organization. The SQ3R technique may be suggested to improve the ability to comprehend materials read.

2. After providing the educational interventions in the preceding section, the same domain-referenced type ability tests for vocabulary, verbal reasoning, and reading comprehension may be again adminstered. Use the domain-referenced ability tests administered before the remediations as pretests and the domain-referenced ability tests that were administered after the educational interventions as posttests. Statistically compare the pretest and posttest scores obtained for statistical gains.

3. Implement additional educational interventions and remediations as needed.

Although this particular study focused on how to help black high school students at the senior level improve their ability on the Verbal SAT component, it would be considered an educational injustice not to address ways to improve similar groups of black students' ability on verbal skills before they reach their senior year in high school. If the particular group of black students in the present study are demonstrating verbal

deficiencies during their senior year in high school, a strong argument may be that black students from a similar population in lower grade levels are exhibiting similar verbal deficiencies. The need may exist, therefore, to examine similar groups of students' ability on verbal skills and offer the remediations and interventions that are needed.

The following educational interventions are recommended for improving students' ability on vocabulary, verbal reasoning, and reading comprehension at earlier grade levels:

1. Initiate tests that measure ability in verbal skills as early as kindergarten in the students' schooling and implement the educational interventions for the weaknesses that are indicated. Longitudinal panel studies on ability may be conducted on the students from their kindergarten year throughout their middle school years (through Grade 8) to explore improvements in their ability and determine interventions and remediations for the verbal skills in which the students may be demonstrating deficiencies. This approach will allow students to develop verbal skills over a period of years and an opportunity to build on verbal concepts as they progress through their schooling

The College Entrance Examination Board (1968) maintains that the verbal and mathematical skills assessed on the SAT develop gradually over many years of learning. The College Board (1968) further proposes that it is, therefore, difficult to significantly improve verbal and mathematics skills through brief methods of educational interventions during the final years of high school when students are preparing to take the SAT. Subsequently, early educational interventions in verbal skills may allow the students an opportunity to improve their verbal ability.

2. Encourage students to take the Preliminary Scholastic Aptitude Test (PSAT) at the Grade 10 level in high school and evaluate their ability in vocabulary, verbal reasoning, and reading comprehension skills. For weaknesses found, the necessary remediations and interventions similar to those suggested for Grade 12 students may be implemented to improve ability.

3. At Grade 11 level, students may be encouraged to take the SAT and a statistical comparison be performed between the verbal scores obtained on the PSAT and the verbal scores received on the SAT for significant gains to determine improvement in ability. This strategy would also indicate whether the remediations and interventions have exerted significant improvement in ability on the skills in vocabulary, verbal reasoning, and reading comprehension that are assessed on the Verbal SAT. If needed, additional remediations and interventions may be launched.

4. Students who have not shown the desired improvement in verbal ability may be encouraged to again take the SAT their senior year in high school, at the beginning of the school year. The results may be analyzed for improvement and, if need, further interventions may be designed. At this point, a summative evaluation of the students' ability in vocabulary, verbal reasoning, and reading comprehension that are included on the Verbal SAT component may be done and more intense interventions implemented, if needed. The students may repeat the SAT.

The variable Help-Seeking Behavior Strategies (a resource management strategy) which Pintrich, Smith, and McKeachie (1989) view as learners' skills in seeking help from teachers, peers, and others exerted the second most significant effect on the particular group of black students' Verbal SAT scores. The significant, positive effect of the variable Help-Seeking Behavior Strategies evidences that students' increase in skills that entail seeking help from others may increase their Verbal SAT scores. More specifically, an increase in the use of seeking help from peers, teachers, and others by the group of black students represented in this study may increase their skills in vocabulary, verbal reasoning, and reading comprehension that are measured on the Verbal SAT component.

The literature showed support for the significant, positive effect of the variable Help-Seeking Behavior Strategies on students' academic achievement. Pintrich (1989) states that students' skills in knowing when and how to seek and obtain help or support

from others are significantly related to academic achievement. Sternberg (1985) points out that good students know when they don't know something and are able to identify appropriate resources to provide needed assistance. Thus, black high school students at the senior level in the present study and other black students similar to them may benefit significantly from instruction and training in help-seeking behavior strategies.

Suggestions on how to help the selected group of students acquire help-seeking behavior strategies for verbal achievement include a proposed "Help-Seeking Behavior Strategies Instructional and Training Model" which may consist of the following strategies.

1. Role-playing activities and explanations on the significant effects that seeking support from others have on verbal achievement as a means of helping students to develop a positive attitude about seeking help from others. Several researchers (Ames, 1983; Ames & Lau, 1982), propose that seeking help from others may involve an ego perception. If students are focusing on their ego, the students who attribute low ability as the need to seek help from others are less likely to seek the help or support of others than students who perceive the specific involved learning task as the need for seeking the help.

Interestingly, Barnes, Ickes, and Kidd (1979) concluded that students were more likely, on the other hand, to also give help to other students if the need for the help was perceived as low ability. Subsequently, sessions concentrating on the effect of help-seeking behavior strategies on academic achievement may improve the students' attitudes about seeking help from others and also about giving help to others. Thus, instruction in help seeking skills may benefit the help seeker and the help giver.

A word of caution is applicable for the help-seeking behavior strategies instruction and training. Students should be informed that in seeking help from others, they should not rely completely on others but must first attempt to, at least, complete learning tasks on their own. Likewise, students and teachers providing assistance to students should ensure that the students have put forth effort of their own first. Thus, instructions and training on help-seeking

strategies should focus on a need and not just students seeking help because they failed to attempt to perform a learning task and want someone else to do it without efforts of their own.

2. Dyadic teacher-student interactions, especially with at-risk students who have demonstrated verbal deficiencies. Palinscar (1986) found that this type of dialogue between teacher and student provided means for teacher assistance and for the adjustment of that support.

3. Small groups for various verbal learning activities with students who have demonstrated high verbal achievement as group leaders.

4. Cooperative pairing of students in verbal learning activities. Several researchers support the positive effect of cooperative learning on students' academic achievement (Ames, 1981; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Slavin, 1983).

5. Orientate students to various technological information systems from which they can receive helpsuch as telecommunications, interactive video, Texsearch systems, and other educational systems.

6. Students may be provided guided learning activities on verbal material and teachers may help them recognize when they may need help or support from others.

The regression equation on the Verbal SAT scores further evidenced that the variable Self-Regulation Strategies (a metacognitive strategy) showed the third most significant effect on the Verbal SAT scores. The significant, positive effect of the variable Self-Regulation Strategies indicates that students' increase in the use of skills in reviewing, test-taking, adjusting, and regulation may improve their mastery of vocabulary, verbal reasoning, and reading comprehension that are assessed on the Verbal component of the SAT and simultaneously increase their Verbal SAT scores. The literature suggests that the variable Self-Regulation Strategies has a great impact on academic achievement.

According to Pintrich (1989), self-regulation strategies which include skills in adjusting, re-reading, reviewing, and effective test-taking strategies enable students to adjust, monitor, and regulate their own learning as they proceed through any learning task which significantly increase students' academic achievement. Several other researchers (Arlin & Whitley, 1978; Bandura, 1986; Weinstein & Mayer, 1986; Zimmerman, 1986) concur that self-regulation strategies enable students to become independent learners in which they are able to achieve any desired learning goal. They have further suggested that students be instructed in the use of self-regulation strategies. This lends strong support for self-regulation strategiestraining. Frierson (1986) argues that self-regulation strategies, especially the test-taking techniques, increase black students' accuracies and levels of confidence on standardized tests and subsequently increase black their performance on standardized tests.

From the perspective of Frierson (1986), An inference may be drawn that instruction in test-taking techniques may imporve black students' SAT scores. In addition to the instruction and training in how to take tests, the students may be instructed on how to process the information on the test simultaneously while responding to the test items so that they will develop skills in not only how to "bubble" in answers but also in how to process the information on which the test is designed. This approach to test-taking strategies will enable students to acquire lifelong skills to successfully perform on the cognitive content of any verbal measure. Test-taking strategies, however, is only one subcomponent of self-regulation strategies. Instruction and training in self-regulation strategies should also include the other self-regulation strategies (reviewing, adjusting, and regulating).

A model for instruction and training in self-regulation strategies may include the following teaching approaches:

1. Instruct students on self-regulation learning strategies by utilizing explanations and examples through overt modeling by the teachers.

2. Demonstrate to students how to use the self-regulation strategies of reviewing, test-taking, adjusting, and regulation by utilizing an actual class assignment that students have to complete and do the following aloud:

   a. State the desired outcome of the specific assignment.

   b. Select a particular self-regulation strategy and state why the particular strategy was selected.

   c. Check as you proceed through the assignment to determine if you're accomplishing the desired goal.

   d. Review information by reciting it or by designing self-tests.

   e. Make necessary corrections.

   f. Adjust your information-processing approach.

3. Give students a learning activity and allow them to practice self-regulation strategies by using their own self statements overtly and provide corrective feedback.

4. Help students to identify self-regulation strategies by observing their use of them and give them immediate feedback when they use a particular self-regulation strategy, including the name of the specific self-regulation strategy that was used.

5. Design verbal learning activities and instruct students to covertly perform a task analysis of the self-regulation strategies they utilized, including making their own tests, finding their own errors, and making their own corrections.

6. Provide students with sample standardized verbal measures and instruct them on test-taking strategies through guided practice. Administer standardized verbal measures periodically and do formative and summative assessments of the test-taking strategies.

Boyd (1980) strongly argues that black students outperform their SAT scores as determined from their grade point averages and other academic criteria. From this perspective, it may be implied that black students' academic deficiencies reported by the SAT scores may be a lack of sufficient test-taking skills. Considering this point of view, it may be very beneficial to the group of black students in this present study and to other black students similar to them to be provided instruction and training in test-taking skills congruent to the concepts of the information involved. The test-taking strategies, however, may be most helpful if they can be generalized to any academic task.

On the Mathematics SAT scores, the variables Ability and Self-Regulation Strategies indicated significant, positive effects while the variables Sex and Critical Thinking Strategies suggested significant effects but in the inverse direction. Of the variables, Ability evidenced the strongest significant, positive effect on the Mathematics SAT scores. This effect of ability indicates that an improvement in the students' ability may increase their skills in problem solving in arithmetic, elementary algebra, and geometry that are assessed on the Mathematics SAT section.

The literature revealed several researchers (Haertel & Walberg, 1980; Ugurogly & Walberg, 1986) that provide support for the positive, significant effect of ability on mathematics achievement similar to the argument for the positive, significant effect of ability on verbal achievement. The strategies recommended in the present study students' for improving the selected group of black students' verbal ability are also suggested for improving their Mathematics ability, except the learning tasks and materials would be mathematics rather than verbal. The domain-referenced ability tests would include problem solving arithmetic, elementary algebra, and geometry.

The variable Self-Regulation Strategies had the third strongest significant effect on the Mathematics SAT scores but was the second strongest, significant effect in the positive direction. Shapiro (1988) stresses the positive, significant effect of the variable Self-Regulation Strategies on mathematics achievement. Subsequently, this finding of the significant, positive effect of self-regulation strategies on this particular group of black students' Mathematics SAT scores expands the existing body of literature on the significant effect of self-regulation strategies on mathematics achievement.

The proposed model for the implementation of self-regulation strategies for improving the Verbal SAT scores that was presented in the discussion section of this present study is also applicable for self-regulation strategies to improve the Mathematics SAT scores. The standardized measures and learning materials would, however, focus on mathematics. The mathematics skills in problem solving in arithmetic, elementary algebra, and geometry would be assessed.

The multiple regression analyses showed the variables Sex and Critical Thinking Strategies to have the second and fourth strongest significant effects on the Mathematics SAT scores, respectively. The direction of the variables Sex and Critical Thinking Strategies, however, was inverse. Although the effects of the variables Sex and Critical Thinking Strategies on the Mathematics SAT scores were inverse, this is not an indication for their exclusion from schools' curriculums. Rather, these results highlight a need for further examination of the effects of sex differences and of critical thinking strategies on the Mathematics SAT scores and perhaps even on mathematics achievement, in general. Special attention may need to focus on the nature of the critical thinking strategies that especially black students are receiving in mathematics.

A plausible explanation, however, for the significant, inverse effect of critical thinking strategies on the selected group of black students' Mathematics SAT scores may

imply that critical thinking skills cannot compensate for the mathematical skills that the students should have developed gradually over the years. Another possible explanation may be the confounding theories surrounding a general definition for critical thinking and how to teach critical thinking skills (Pintrich, 1989). These plausible explanations still incite the need for further investigations of critical thinking strategies on the Mathematics SAT scores of black students from the population in the present study.

The findings from the regression analyses by sex on the independent variables for effects on the dependent variables indicated significant sex differences on several independent variables. Significant sex differences, for example, were found on the variable Ability favoring females on the Verbal SAT scores and favoring males on the Mathematics SAT scores. Results also showed significant sex differences on the variable Self-Regulation Strategies favoring males on the Verbal SAT scores and on the Mathematics SAT scores. Further significant sex differences were found on the variables Organization Strategies and Critical Thinking favoring females on the Mathematics SAT scores, although the effect of the variable Critical Thinking Strategies was inverse.

The significant, inverse effect of the variable Critical Thinking Strategies on the Mathematics SAT scores of females suggests that an increase in critical thinking strategies by females may decrease their Mathematics SAT scores. This is alarming since Pintrich (1989) points out that knowledge in different disciplines may change rapidly in our society which will make critical thinking strategies essential for students to evaluate new ideas and concepts. From this perspective, black females may find themselves in a passive academic role in a highly technologized society if they lack the necessary critical thinking strategies to evaluate new concepts.

Several plausible explanations, however, may be provided for the significant, inverse effect of critical thinking strategies on the selected group of black females'

Mathematics SAT scores. According to Badger (1981), cultural milieu reinforced by society has not encouraged females to challenge mathematics which has contributed to their lesser interest in mathematics than males. Predicated on this assumption, a possible explanation may point to a social attitude on females' analytical skills on mathematics that may have generated a gap between males and females on critical thinking skills applicable to mathematics, with females demonstrating a lack of confidence in critical thinking skills.

Although the preceding explanation for the significant, inverse effect of critical thinking skills on the selected group of black females' Mathematics SAT scores has a social connotation, a curriculum-based plausible explanation may also be extrapolated. Several authors, for example, have proposed that the strength of students' high school academic preparation from advanced courses in science and mathematics is strongly related to the SAT scores and that more males pursue these types of courses than females (College Board, 1989; Pedro, Wolleat, Fennema, & Decker, 1981). The development of skills in critical thinking is also allegedly embedded in these courses. Since a large number of females have not challenged the advanced science and mathematics courses, they have not have developed successful critical thinking skills.

The significant, positive effect of the variable Ability on the Verbal SAT scores for females and on the Mathematics SAT scores for males is also interesting. It is assumed to a large extent, that females demonstrate greater ability on verbal achievement while males demonstrate greater ability on mathematics achievement. This assumption finds support from several researchers (Donion, Ekstrom, & Lockheed, 1976; Dweck, 1986; Maccoby & Jacklin, 1974). Whether this finding can be substantiated by a theoretical framework of males and females learning in different ways or by the issue of education inequity between males and females, it most certainly should incite further investigation.

Overall, the sex differences found on the Verbal and Mathematics SAT scores may imply that a different set of learning strategies is important for females and males. The sex differences identified in the present study augment the research on sex differences in education. A current issue under much debate is the separate sex classes for black males and females. The information on sex differences evidenced in the present study is especially useful to educators in helping to determine if separate sex classes for black students are warranted.

Despite the self-regulation strategies that enable students to become independent learners, their need for skills in seeking help from others that was evidenced in the present study should not be ignored. The significant, positive effects of the variables Ability, Help-Seeking Behavior Strategies, and Self-Regulation Strategies on the Verbal SAT scores may be considered in schools' curriculum. The variables Ability and Self-Regulation Strategies on the Mathematics SAT scores of the black students in the present study also have implications for curriculum design.

Administrators of education may, for example, include more ability assessments, more instructions on how to use resources and how to manage the resources, and add information-processing dimensions that encourage independent learning in the contents of the curriculums. The strategies for the implementation of the variables Ability, Help-Seeking Behavior Strategies, and Self-Regulation Strategies for the Verbal SAT scores and also the variables Ability and Self-Regulation Strategies for Mathematics SAT scores, however, do not advocate isolation of these variables ffrom instruction. Rather, it is recommended that these positive, significant variables be integrated into the content areas of the existing school curriculums and teaching models. The interplay of the preceding variables and the concepts of the curriculum contents may be the panacea for black students' gains on the Verbal and Mathematics SAT scores and may also simultaneously improve their curriculum-based performance.

A major concern throughout this study was not to mislead readers that the SAT scores were the primary focus of students' academic achievement. Rather, the emphasis is on the verbal and mathematical skills that are included on the SAT which students should have acquired by their senior year in high school. These verbal and mathematical skills in which black students are exhibiting deficiencies are the primary concern of educators.

Although the variables found to have significant, positive effects on the Verbal and Mathematics SAT scores indicated potentials for improving black students' SAT scores, the limitations of the present study must be recognized. It is important to be cognizant that the students in the present study were all black students. Furthermore, they were all high school seniors in urban inner-city schools. The generalization of the study is, therefore, limited by the nature of the sample. Thus, the foregoing discussion must be viewed in the context of the total experiences of the selected group of students.

On the other hand, in the absence of contrary evidence, it may be assumed that the particular group of black students in the present study and others similar to them may increase their Verbal and Mathematics SAT scores from the significant, positive variables identified in the study. With respect to these variables, it is worth the efforts of educators to, at least, further investigate them. In fact, the results of the present study have highlighted the need for further research in several areas.

The effects of learning strategies on black students' verbal and mathematics achievement, for example, need to be studied systematically, especially for effects on the Verbal and Mathematics SAT scores. More studies need to concentrate on the nature of critical thinking strategies. The sex differences in education and the issues surrounding them may provide another area for further investigation. Special attention to the findings in the present study is of great importance if black males and females are to be recipients

of the merits of scholarship determined by the SAT scores that will qualify them for the more advanced educational opportunities.

References

Alderman, D. L., & Powers, D. E. (1980). The effects of special preparation on SAT-verbal scores. American Education Research Journal, 17, 239-251.

Ames, C. (1981). Competitive versus cooperative reward structures: The influence of individual and group performance factors on achievement attributions and affect. American Educational Research Journal, 18, 273-287.

Ames, R. (1983). Helping-seeking and achievement orientation: Perspectives from attribution theory. In B. M. DePaulo, A. Nadler, & J. D. Fisher (Eds.), New directions in helping (pp. 165-188). New York: Academic Press.

Ames, R., & Lau, S. (1982). An attributional analysis of student help-seeking in academic seetings. Journal of Educational Psychology, 74, 414-423.

Anderson, J. R. (1983). The architecture of cognition. Cambridge, MA: Harvard University Press.

Arlin, M., & Whitley, T. W. (1978). Perceptions of self-managed learning opportunities and academic locus of control: A casual interpretation. Journal of Educational Psychology, 70, 988-992.

Badger, M. E. (1981). Why aren't girls better at math? A review of research. Educational Research, 24, 11-22.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Barnes, R. D., Ickes, W. J. & Kidd, R. (1979). Effects of perceived intentionality and stability of another's dependency on helping behavior. Personality and Social Psychology Bulletin, 5, 367-372.

Boyd, W. H., II. (1980). Black students out perform their SAT score. Independent School, 39, 35-37.

Brown, D. C. (1987, April). Aptitude test score trends: 1959-1984. Paper presented at the Annual Meeting of the American Educational Research Association, Washington, DC.

College Board (1989). For release Tuesday, September 12, 1989. New York, NY: College Board Publications.

College Board (1990). College-Bound Seniors: 1990 profile of SAT and Achievement Test Takers. New York, NY: College Board Publications.

College Entrance Examination Board (1968). Effects of coaching on Scholastic Aptitude Test scores. New York: College Board Publications.

Corno, L., & Mandinach, E. B. (1983). The role of cognitive engagement in classroom learning and motivation. Educational Psychologist, 18, (2) 88-108.

Donlon, T., Ekstrom, R., & Lockheed, M. (1976). Comparing sexes on achievement items varying content. Paper presented at the annual meeting of the American Psychological Association, Washington, D. C.

Dweck, C. S. (1986). Motivational processes affecting learning. American Psychologist, 41, 1040-1048.

Frierson, H. T. (1984). Impact of an intercention program on minority medical students' national board part I performances. Journal of the National Medical Association, 76, 1185-1190.

Frierson, H. T. (1986). Enhancing minority college students' performance on educational tests. Journal of Negro Education, 55, 38-45.

Haertel, G. D., & Walberg, H. J. (1980). Ability and learning: A theoretical and empirical synthesis. (Report No. NIB-678-0090). Washington, D. C. National Institute of Education. (Eric Reproduction Service No. ED 206047)

Hunt, E. (1978). Mechanics of verbal ability. Psychological Review, 85, 109-130.

Irwin, M., Engle, P.L. Yarbrough, C., Klein, R. E., & Townsend, J. (1978). The relationship of prior ability and family characteristics to school attendance and school achievement in rural Guatemala. Child Developement, 49, 415-427.

Johnson, D. W., Maruyama, G., Johnson, R., Nelson, D., Skon, L. (1981). Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis. Psychological Bulletin, 89, 47-62.

Kulik, J. A., Bangert, R. L., & Kulik, C.L.C. (1982). Effects of coaching programs on aptitude test scores. Unpublished manuscript, University of Michigan.

Larkin, J. (1981) Cognition of learning physics. American Journal of Physics, 49, 534-541.

Maccoby, E. E., & Jacklin, C. N. (1974). The psychology of sex differences. San Francisco: Stanford University Press.

Marron, J. E. (1965). Preparatory school test preparation: Special test preparation, its effects on college board scores to subsequent college performance. West Point, NY: United States Military Academy.

McGeever, J. M. (1983). The decline of standardized test scores in the United States from 1965 to present. (Report No. AEL-OP-012). Charleston, W. VA: Appalachia Education Laboratory. (ERIC Document Reproduction Service No. ED 252 565)

McKeachie, W. J., Pintrich, P. R., & Lin, Y. (1985). Teaching learning strategies. Educational Psychologist, 20, 153-160.

Messick, S. A., & Jungeblut, A. (1981). Time and method in coaching for the SAT. Psychological Bulletin, 89, 191-216.

Palinscar, A. S. (1986). The role of dialogue in providing scaffolded instruction. Educational Psychologist, 21, 73-98.

Pallone, M. J. (1961). Effects of short- and long-term developmental reading course upon SAT verbal scores. Personnel and Guidance Journal, 39, 654-657.

Pedro, J. D., Wolleat, P., Fennema, E., & Becker, A. D. (1981). Election of high school mathematics by females and males: Attribution and attitudes. American Educational Research Journal, 18. 207-208.

Pintrich, P. R. (1989). The dynamic interplay of student motivation and cognition in the college classroom. In M. Maehr & C. Ames (Eds.), Advances in motivation and achievement: Motivation enhancing environments (pp. 117-160). JAI Press.

Pintrich, P. R., Smith, D. A. F., &McKeachie, W. J. (1989). A manual for the use of the motivated strategies for learning questionnaire. Ann Arbor: The University of Michigan, School of Education.

Powers, D. E., & Alderman, D. L. (1983). Effects of familiarization on SAT performance. Journal of Educational Measurement, 20, 71-79.

Shapiro, L. J. (1988). Effects of written metacognitive and cognitive strategy instruction on the elementary algebra achievement of college students in a remedial mathematics course. (Doctoral dissertation, Teacher's College, Columbia University, 1988) Dissertation Abstracts International, 48, 5502A.

Slavin, R. E. (1983). When does cooperative learning increase student achievement? Psychological Bulletin, 94, 429-445.

Sternberg, R. J. (1985). Beyond I.Q. Cambridge, MA: Cambridge University Press.

Steinkamp, M. W., & Maehr, M. L. (1983). Affect, ability and science achievement: A quantitative synthesis of correlational research. Review of Educational Research, 53, 369-396.

Thomas, J. E., & Rohwer, W. D. (1986). Academic studying: The role of learning strategies. Educational Psychologist,21, 19-41.

Uguroglu, M. E., & Walberg, H. J. (1986). Predicting achievement and motivation. Journal of Research and Development in Education, 19. 1-8.

Vaidya, S., & Chansky, N. (1980). Cognitive development and cognitive style as factors in mathematics achievement. Journal of Educational Psychology, 72, 326-330.

Weinstein, C. E. (1982). Training students to use elaboration strategies. Contemporary Educational Psychology, 7, 310-311.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. In M. C,. Wittrock (Ed.), Handbook of research on teaching (pp. 315-326). New York: MacMillan.

Weinstein, C. E., Underwood, V. L. (1985). Learning strategies: The how of learning. In J. W. Segal & R. Glaser(Eds.), Thinking and learning skills (pp.241-327). Hillsdale, NJ: Lawrence Erlbaum.

Weinstein, C. E., Zimmerman, S. A., & Palmer, D. R. (1985). Assessing learning strategies: The design and development of the LASSI. Austin: University of Texas.

Zimmerman, B. J. (1986). Development of self-regulated learning: Which are the key subprocesses? Contemporary Educational Psychology, 16, 307-313.

Zimmerman, B. J., & Pons, M.M. (1986). Development of structural interview for assessing student use of self-regulated learning strategies. American Educational Research Journal, 23, 614-628.

Zuman, J. P. (1988, April). The effectiveness of special preparation for the SAT: An evaluation of a commercial coaching school. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.